differs from the others in that it treats general physiological characteristics and their consequences for population energetics in two major taxa, the reptiles and amphibians. The common physiological traits of ectothermy and anaerobic metabolic support for locomotor activities in these two distantly related vertebrate groups appear to be responsible for the ecological patterns consequently held in common—low individual rates of energy flow and high population efficiencies of biomass conversion by contrast to the situation in endotherms.

Larry Crowder and John Magnuson use several examples of fish research to illustrate the value of multidimensional cost-benefit analysis of energy acquisition and expenditure; they explore the theory and supporting evidence for the idea that the selection of thermal regimes and feeding options comprises a common, integrated set of behavioral decisions that optimize the net rate of energy gain that is convertible to growth. Larry Wolf and Reed Hainsworth address the extensively researched problems associated with foraging behavior in nectar-eating birds (hummingbirds and sunbirds), and present one of the fundamental messages of the symposium: foraging decisions are dependent upon time and environmental situations that influence the energy balance of animals on minute-by-minute, day-by-day, and seasonal bases.

The papers in this volume do not combine to provide immediately a single, self-evident story. They do represent, however, an informative and instructive collection that should be useful to those working in ecology, behavior, physiology and evolutionary biology, because they illustrate how the study of energy balance could profitably enhance a wide variety of current behavioral and ecological research.

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THE EVOLUTION OF INSECT MATING SYSTEMS. *By Randy Thornhill and John Alcock. Harvard University Press, Cambridge (Massachusetts).* $35.00. xi + 547 p.; ill.; author and subject indexes. 1983.

Reading this book will be an important event for anyone interested in insects or evolution. Its breadth, detail, intriguing illustrations, and lucidity in explaining complex theory are both enlightening and exciting. I suspect its usefulness will not be limited to the audience of "professional entomologists and beginning students of animal behavior" proposed in the Preface. Insect behavior has been a font of evolutionary wisdom ever since Darwin's fascination with beetles, and I imagine that *Evolution of Insect Mating Systems* will inspire research on any number of creatures other than insects.

The book can be divided into three parts. In the first, the authors explain natural selection, define the modes of insect reproduction, and describe the workings of sexual selection. A number of difficult topics, such as the costs and benefits of sexuality, and the optimization of organisms, are handled with clarity. The explanation of the comparative method in testing hypotheses should stifle the occasionally heard complaint, "But where is the control!" There is an interesting suggestion that the value of sexuality can be tested by looking for the ecological correlates of inbreeding. Noteworthy also is the consideration of ambiguous results such a test might produce. Throughout the book there is this attention to alternative explanations that is not always present in the behavioral ecology literature. I would take issue, however, with the authors' treatment of selection levels. It seems unnecessary and confusing to maintain that the individual is the unit of selection, while considering the gene the unit of evolution. Admittedly, it often makes little difference on which of these levels selection is said to occur. But, when it does make a difference, individual-level thinking leads to confusion and error (e.g., the nonissue in kin selection of exact versus probabilistic relatedness).

The second part of the book discusses the intrasexual selection of the behaviors and structures that males use in competition for mates. One outstanding feature is the clear explanation of how female mating frequency influences whether males will search for mates at oviposition, feeding, or emergence sites. Their review of variation in male mating systems is likely to be consciousness-raising. Many entomologists consider insects no more complicated than a child's wind-up toy somehow come to life. Cataloguing the responses males make to changes in their reproductive environment will create an assumption of insect sophistication in the minds of entomologists that may cause them to ask some new questions of their familiar animals. Here, as throughout the book, detailed case studies complement more general discussions.

The third section, which deals with epigamic (intersexual) selection, is particularly engrossing. The reader's interest is heightened by seeing how little is known and the obvious need for fundamental research to map the *terra incognito*. There is debate, for instance, over the function of male displays and what it is about males that females choose (or whether they choose at all). Of the many views, two are particularly influential. The first is that Fisherian run-away selection results in

female mate choice based on esthetic grounds that are uncorrelated to male genetic qualities other than those involved with providing the display. The second is that displays of vigor, size, and agility advertise heritable qualities or at least the absence of deleterious mutations. While admitting the possibility of the first idea, the authors enthusiastically pursue the implications of the second. The power of this point of view in providing working hypotheses is amply demonstrated. Besides picking genes, a female may choose males that provided a material investment to her well-being or that of her offspring. A suggestion made less than a decade ago by one of the authors (R.T.) that there might be advantageous substances in spermatophores/ejaculates has grown into a subdiscipline of insect behavioral ecology. The discussion of such male investment includes some elegant substantiations of sexual selection theory itself (e.g., Gwynne's work on Mormon crickets).

It is impossible to draw attention to all the useful syntheses, new ideas, and old ideas freshly explained that abound in this book. I think it is destined to become a classic.

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HERBIVOROUS INSECTS: HOST-SEEKING BEHAVIOR AND MECHANISMS.

Edited by Sami Ahmad. Academic Press, New York. $34.50. xvi + 257 p.; ill.; index. 1983.

The ability of herbivorous insects to locate their host plants has been a source of fascination and frustration to entomologists and ecologists, as well as behaviorists and evolutionary biologists. Although a number of recent books have examined herbivore-plant interactions, none has focused on the behavioral mechanisms of host location by herbivores. As editor, Sami Ahmad has compiled a series of papers which address this topic in a way that is useful to readers with a variety of backgrounds and interests.

The volume is organized into four sections ranging from the neurological to the evolutionary aspects of host location by insects. Also explored are the diversity of environmental cues and the influence of diet breadth on the resource search patterns of herbivores.

A theme developed throughout the volume is one of host-seeking as a sequential process, deeply imbedded in the insect's physiology. Consequently, many of the papers are written using a case-history approach. This serves to focus attention on the interrelatedness of an insect's physiology and behavior; in many cases, however, it tends to obscure the broader implications of the idea being developed.

Stanton employs a broader approach in exploring the influences of plant community texture on the search for a host; he points out some difficulties in assessing these effects in natural and man-made ecosystems. In a similar style, Papaj and Rausher address the influence of learning, age, and environmental factors on an individual insect's host-finding behavior.

A second theme is the attempt to understand insect host-seeking behavior on the basis of dietary breadth—i.e., do generalists and specialists exhibit different and distinguishable patterns of host location? This question is addressed by Lanier, by May and Ahmad, and by Lance, as they seek to characterize and compare host search in monophagous, oligophagous and polyphagous insects. The approach is useful to an extent, but the exceptions they provide (e.g., polyphagous insects that use long-range olfactory cues) suggest that generalist-specialist comparisons may be too simplistic to be of broad use.

Overall, the book succeeds in that it addresses itself to a poorly understood area of plant/herbivore biology and exposes the complexity of this important subject. The unfinished feeling one has after reading this volume stems more from the state of the field than from the quality or organization of the book. The field appears to be at a point where knowledge of the complexity of host-finding mechanisms has outstripped our ability to integrate them ecologically. The ideas and information presented in this volume provide a basis for filling these gaps in our understanding.

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ECHOLOCATION IN WHALES AND DOLPHINS.

By P. E. Purves and G. E. Pilleri. Academic Press, London and New York. $44.00 xiv + 261 p.; ill.; index. 1983.

This book presents a mixture of fact—on the anatomy of the odontocete cetacean larynx, ear, and related structures—and fiction—on the supposed production, pathways, and reception of delphinid sounds. The authors have put forth this book, by their own admission, mainly as a protest to several widely held opinions about sound production and reception in toothed whales.

The prevalent school of thought, led by Kenneth Norris of the University of California at Santa Cruz, states that dolphins produce most sounds near a set of nasal passages above the bony nares, that these sounds are efficiently transmitted through the fatty tissue of the fore-